of the sockets. The notches found in the species referred to *Saurodon* show the earliest stages of this migration.

The distinguished palæo-ichthyologist, Mr. A. S. Woodward, has recently kindly called my attention to a suggestion made by Prof. E. D. Cope that the Saurocephalidæ are closely related to the Chirocentridæ, represented by the large *Chirocentrus dorab* of the Chinese and Indian seas. I have unfortunately had no opportunity to study a skeleton of this fish; but, judging from the figures of the fish found in Cuvier and Valenciennes, pl. 565, and in Day's 'Fishes of India,' pl. clxvi. fig. 3, its external appearance must be much like that of the extinct *Xiphactinus*. Nevertheless, we have no intimations that the teeth of *Chirocentrus* are fixed to the jaws in any way different from those of ordinary fishes. The fixation of the teeth in sockets is an unusual thing among fishes; and this character alone, it appears to me, is sufficient to remove *Xiphactinus* and its allies from the Chirocentridæ, although not necessarily to a great distance. I suspect that the Saurocephalidæ will, when they are better known, show distinctive characters in the vertebral column also.

LXVI.—*Note on* Scapanorhynchus, *a Cretaceous Shark apparently surviving in Japanese Seas.* By A. Smith Woodward, F.L.S.

In his paper on the Cretaceous fishes from Mount Lebanon published twelve years ago *, the late James W. Davis gave an unsatisfactory description and figure of a remarkable new shark under the preoccupied generic name of *Rhinognathus*. He pointed out some of its principal characters, and, notwithstanding the demonstrated presence of an anal fin, placed the fish in the family Spinacidæ. In 1889 †, after a detailed study of the fine series of specimens in the British Museum, the present writer published an amended definition of the genus under the new name of *Scapanorhynchus*, placing it in the family Lamnidæ close to the well-known existing genus *Odontaspis*. The dentition was shown to be identical with that of the latter genus; but other characters, such as the slenderness of the fish, the peculiar elongation of the rostrum,

* J. W. Davis, "On the Fossil Fishes of the Chalk of Mount Lebanon, in Syria," Trans. Roy. Dublin Soc. [2] vol. iii. (1887), p. 480, pl. xiv. fig. 4.

† A. S. Woodward, 'Catalogue of Fossil Fishes in the British Museum,' part i. (1889), p. 351.

and the great extent of the anal fin, seemed to justify at least its generic separation. At the same time it was suggested that many so-called teeth of *Odontaspis* from the Cretaceous formations of other parts of the world might truly belong to *Scapanorhynchus*, and in that case would indicate the very wide distribution of this shark in the seas at the close of the Mesozoic era. It was also remarked that while all the teeth in the two typical species from the Lebanon seemed to bear a pair of lateral denticles, the hinder teeth alone possessed these denticles in certain other species, *e. g.*, in *Scapanorhynchus rhaphiodon* from the European Chalk *.

Within the last ten years nothing of importance has been added to our knowledge of the Cretaceous *Scapanorhynchus*; but quite recently, in the present writer's opinion, new information on the subject has come from an unexpected source. A shark in all essential respects identical with the supposed extinct genus in question has been described by Dr. D. S. Jordan † from the deep sea off Yokohama, Japan. It was obtained from a fisherman by Mr. Allen Owston, of Yokohama, and presented by him to the Zoological Museum of the University of Tokio. It was lent to Dr. Jordan for description by Prof. Mitsukuri, and has received the new generic and specific name, *Mitsukurina Owstoni*. The shark is recognized by Dr. Jordan as more nearly related to *Odontaspis* than to any other surviving genus; but, for reasons not definitely formulated, it is considered to be the type of a distinct family, Mitsukurinidæ.

The Lebanon fossils, of course, are marred by many imperfections; but it appears that, in all the generic characters which can be compared, the living *Mitsukurina* agrees with the Cretaceous *Scapanorhynchus*. Generic differences may still be found, but they have yet to be pointed out. Like that of the recent fish, the skeleton of the fossil may be appropriately described as flexible. The elongated rostrum is identical in the two cases, only relatively longer in the extinct species from Mount Lebanon. The fossils naturally do not exhibit the peculiar indentation between the mouth and the rostrum. One specimen of *Scapanorhynchus Lewisi* (Brit. Mus. no. 49474) clearly shows four branchial clefts immediately in front of the pectoral fin, so that the fifth

* See especially figures by A. S. Woodward, "Notes on the Sharks' Teeth from British Cretaceous Formations," Proc. Geol. Assoc. vol. xiii. (1894), p. 196, pl. v. figs. 11–13.

† D. S. Jordan, "Description of a Species of Fish (*Mitsukurina Owstoni*) from Japan, the Type of a Distinct Family of Lamnoid Sharks," Proc. California Acad. Sci. [3] Zool. vol. i. no. 6 (1898).

would doubtless be above the base of the pectorals, as recorded by Jordan in *Mitsukurina*. Another specimen (Brit. Mus. no. P. 4769) shows that the teeth in *S. Lewisi* are about as numerous as in *Mitsukurina Owstoni*, while, as in the latter species, those at the mandibular symphysis are slightly larger than those at the front of the upper jaw. All the fins are known in the two fossil species from Mount Lebanon except the anterior dorsal; and on comparing the figure of such a specimen as B. M. no. P. 4020 * with that of the recent fish given by Jordan, it will be observed that the differences in proportions are not of greater than specific value. The arrangement of the basal cartilages of the fins, so beautifully represented by Jordan, is unfortunately not distinct in any of the Lebanon fossils; nor is there any clear evidence of the claspers. The dense shagreen seems to be similar in the recent and fossil forms.

The type specimen of *Mitsukurina Owstoni* measures slightly more than a metre (42 inches) in length, and is described as apparently young. The known specimens of *Scapanorhynchus Lewisi* cannot have attained a greater length than 0·5 m., while the only complete specimen of *S. elongatus* measures about 0·65 m. in length. Some of the other species, however, represented in Cretaceous formations solely by their teeth, evidently attained considerably larger dimensions, and must have been very much larger even than the Japanese fish now captured. In Cretaceous seas it was evidently a dominant type among the predaceous sharks.

LXVII.—*Note on some Cretaceous Clupeoid Fishes with Pectinated Scales* (Ctenothrissa *and* Pseudoberyx). By A. Smith Woodward, F.L.S.

A recent detailed study of the so-called Berycidæ of the Cretaceous period has led to the recognition of several allies of the herrings among them. There is evidence of at least two genera, whose osteological characters necessitate their reference to the family Clupeidæ as defined in Dr. Günther's British Museum Catalogue. Both are characterized by large pectinated scales, like those of the existing Clupeoid genus *Brevoortia* †; but neither exhibits any ventral or dorsal ridge-

* A. S. Woodward, 'Catal. Foss. Fishes B. M.' part i. (1889), pl. xvii. fig. 1.

† Gill, Proc. Acad. Nat. Sci. Philad. 1861, p. 37; Jordan and Evermann, "Fishes of North and Middle America," Bull. U.S. National Museum, no. 47 (1896), p. 433.